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(72) CALEY, Douglas A., US
(72) OLIPHANT, Timothy L., US
(71) PACCAR INC, US

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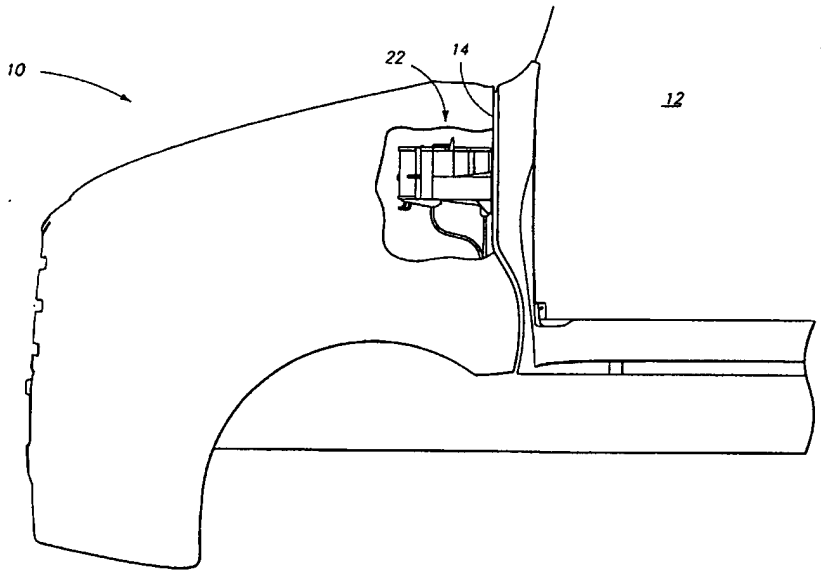
(54) **APPAREIL POUR LE TRAITEMENT DE L'AIR DES CAMIONS ET DES VEHICULES, METHODE D'ASSEMBLEGE ET D'ENTRETIEN DE CE MEME APPAREIL**

(54) **AIR TREATMENT APPARATUS FOR TRUCKS AND VEHICLES AND METHOD OF ASSEMBLING AND SERVICING THE SAME**



(57) TRANSLATION NOT AVAILABLE AT THIS TIME

(57) A vehicle air treatment apparatus and method for assembling and servicing the apparatus are provided. The vehicle air treatment apparatus includes an air handler having at least one heat exchanger module. The at least one heat exchanger module conditions air applied to the passenger compartment of a vehicle and is removable from the air handler without disconnecting the fluid conduits attached thereto. The air handler preferably includes two heat exchanger modules including a heater core module and an evaporator core module. The system and methods allow HVAC units to be serviced or removed without disconnecting refrigerant or coolant lines which are connected thereto.

ABSTRACT

Air Treatment Apparatus For Trucks and Vehicles And Method Of Assembling And Servicing The Same

A vehicle air treatment apparatus and method for assembling and servicing the apparatus are provided. The vehicle air treatment apparatus includes an air handler having at least one heat exchanger module. The at least one heat exchanger module conditions air applied to the passenger compartment of a vehicle and is removable from the air handler without disconnecting the fluid conduits attached thereto. The air handler preferably includes two heat exchanger modules including a heater core module and an evaporator core module. The system and methods allow HVAC units to be serviced or removed without disconnecting refrigerant or coolant lines which are connected thereto.

DESCRIPTION

AIR TREATMENT APPARATUS FOR TRUCKS AND VEHICLES AND METHOD OF ASSEMBLING AND SERVICING THE SAME

Technical Field

This invention relates to vehicle air treatment systems, and methods for assembling and servicing a vehicle air treatment system improving accessibility to components of the vehicle.

Background

Conventional vehicle air treatment systems generally include an air handler for selectively passing air, either fresh air or recirculated air, through a heat exchanger. The heat exchangers typically include a heater core to heat the air supplied to the cab of the vehicle responsive to one of operator or automated control. These systems may also include an air conditioner evaporator core for cooling air supplied to the cab of the vehicle in response to operator or automated control.

The heater core and evaporator core are heat exchanger units which generally comprise one or more conduits. The heater core conduits and evaporator core conduits contain heat transfer fluid such as a coolant or refrigerant, respectively. The coolant may transfer heat from the engine to the air passing adjacent to the heater core. Evaporation of a refrigerant within the evaporator core absorbs heat thereby cooling air passing adjacent to the evaporator core. A plurality of tubes or fluid conduits provide fluid communication of the heater core with the engine and the evaporator core with a compressor and condenser.

The vehicle air treatment systems and vehicle engine must be periodically serviced and maintained for proper performance. It is often necessary to remove the air treatment system to improve access to the components which require servicing. In the past, it has almost always been necessary to remove the refrigerant hoses or coolant hoses to perform this maintenance. The hoses are usually removed from the respective heat exchanger during the servicing of a conventional air treatment system or HVAC unit. Such a procedure requires draining and reclaiming the refrigerant or coolant, pulling a vacuum and/or recharging the system. The coolant hose and refrigerant hose are usually clamped while the air treatment system is being serviced, however, some of the heat transfer fluid may spill.

Thus, there has remained a need for improving constructions and methods for accessing and servicing of vehicle air treatment systems.

Brief Description of the Drawings

Preferred embodiments of the invention are described below with reference to the accompanying drawings, which are briefly described below.

Fig. 1 is a side elevational view of the air handler of the air treatment apparatus in accordance with the present invention mounted on the firewall of a vehicle.

Fig. 2 is a diagrammatic representation of the air treatment apparatus in accordance with the present invention.

Fig. 3 is a block diagram of a processor coupled with components of the air treatment apparatus.

Fig. 4 is a plan view of an embodiment of an air handler of the vehicle air treatment system in accordance with the present invention.

Fig. 5 is a right side elevational view of the air handler shown in Fig. 4.

Fig. 6 is a left side elevational view of the air handler shown in Fig. 4.

Fig. 7 is a rear view of the air handler shown in Fig. 4.

Fig. 8 is a cross-sectional view of the air handler taken along line 8-8 in Fig. 7.

Fig. 9 is a perspective view of an embodiment of an air distributor of the air handler according to the present invention.

Fig. 10 is a front view of the air handler shown in Fig. 4.

Fig. 11 is a plan view of the air handler shown in Fig. 4 with the heater core module and evaporator core module removed therefrom.

SUMMARY EXPLANATION OF INVENTION FEATURES

To assist in understanding and defining the present invention, the description in this section indicates the various features of the present invention in different forms and manners of description. The novelty of the present invention comprises one or more of the features described either in this section, or according to the more detailed description given in the next section.

The present invention includes a vehicle air treatment system preferably having an air handler mounted upon a firewall of the vehicle. The air handler includes at least one removable heat exchanger module. Preferably, the air handler includes two removable heat exchanger modules. The heat exchanger modules may comprise a heater core module and an evaporator core module.

Responsive to automated or operator control, the air handler will heat or cool either fresh air, or recirculated air from the passenger compartment. More specifically, the air handler selectively directs air adjacent the heater core module to selectively heat the air applied to the passenger compartment. In addition, the evaporator core module may selectively cool the air prior to delivery to the passenger compartment of the vehicle.

In accordance with the present invention, the heat exchanger modules are easily removable from the air handler unit to facilitate routine maintenance of the air treatment

apparatus and other vehicle components. The fluid conduits may remain connected to a respective heat exchanger module of the air treatment apparatus during the removal of the heat exchanger module therefrom.

Providing an air treatment apparatus in accordance with the present invention enabling such maintained connection of the fluid conduits to a respective heat exchanger module enables servicing without a need to reclaim a refrigerant or coolant heat transfer fluid, pull a vacuum, clamp the conduits, and/or recharge the system. In addition, maintaining the fluid conduits in continuous, closed communication with the heat exchanger modules reduces spills of the heat transfer fluid from the air treatment apparatus.

The present invention facilitates servicing of the air treatment apparatus itself and other components of the vehicle. These and additional advantages will become more apparent with reference to the detailed description of the preferred embodiments of the present invention below.

Best Modes for Carrying Out the Invention and Disclosure of Invention

TABLE 1

Listing of Subsections of Detailed Description and Pertinent Items with Reference Numerals and Page Numbers

* * * (End of Table 1) * * *

Overview

Referring in more detail to the drawings, Fig. 1 is a side elevational view illustrating the air handler 22 of the air treatment apparatus mounted on a firewall 14 of a vehicle 10. The air handler 22 is proximately located to the passenger compartment 12 for directing treated air into said compartment 12.

Fig. 2 depicts the first and second heat exchanger modules within the air handler 22. First and second heat exchanger modules may be referred to herein as heater core module 24 and evaporator core module 36, respectively. The heat exchanger modules 24, 36 each include a plurality of conduits for circulating a heat transfer fluid such as a coolant or refrigerant throughout the respective module. Alternatively, the air handler 22 may include one heat exchanger module to provide one of heating or cooling of air delivered to the passenger compartment 12.

The heater core module 24 includes fluid connection ports 27, 29 on a front surface thereof in fluid communication with respective fluid port connectors 26, 28. The port connectors 26, 28 are coupled with respective first and second fluid conduits 30, 32. The fluid conduits 30, 32 are coupled with an engine coolant system which circulates coolant heat transfer fluid. The coolant heat transfer fluid may be utilized for heating air delivered to the passenger compartment 12.

More specifically, heat generated by the engine 11 of the vehicle 10 increases the temperature of the coolant heat transfer fluid. The heated coolant heat transfer fluid is applied to the first heat exchanger module or heater core module 24 via fluid conduit 30, port connector 26 and fluid connection port 27. The coolant heat transfer fluid is circulated throughout the heat exchanger module 24 via a plurality of conduits therein. Air adjacent the heater core module 24 is heated and subsequently directed to the passenger compartment 12 responsive to operator or automated control. The coolant heat transfer fluid exits the heater core module 24 via fluid connection port 29, port connector 28 and is returned to the engine via fluid conduit 32.

The evaporator core module 36 of air handler 22 is coupled with a refrigerant compressor 18, a condenser 17 and receiver dryer 19 via a plurality of fluid conduits 42-45. Driven by the engine of the vehicle 10, the refrigerant compressor 18 draws the refrigerant heat transfer fluid from the second heat exchanger module or evaporator core module 36 via fluid conduit 44. Compressor 18 pressurizes the vaporized refrigerant heat transfer fluid. The pressurized heat transfer fluid is applied via fluid conduit 45 to condenser 17 where the heat transfer fluid is pressurized, cooled and liquified.

In liquid form, the heat transfer fluid is thereafter applied via fluid conduit 43 to a receiver-dryer 19 which removes moisture from the refrigerant heat transfer fluid. Fluid conduit 42 couples the receiver-dryer 19 with an expansion valve 15 mounted to the evaporator core module 36. The liquefied refrigerant heat transfer fluid enters the evaporator core module 36 via a fluid port connector 38 engageable with the expansion valve 15 and fluid connection port 39 within the front surface of module 36. The pressure of the refrigerant heat transfer fluid is low within the evaporator core module 36 and the refrigerant heat transfer fluid returns to the gaseous state as it circulates throughout the evaporator core module 36. Such change from a liquid to a gas absorbs heat. Consequently, air passing adjacent the evaporator core module 36 during such evaporation of the refrigerant is cooled and thereafter may be applied to the passenger compartment 12. The refrigerant heat transfer fluid is drawn out of the evaporator core module 36 via fluid connection port 41 and fluid port connector 40, through expansion valve 15 and fluid conduit 44 into the refrigerant compressor 18. The circulation cycle is repeated while the compressor clutch is engaged for cooling air delivered to the passenger compartment 12 of the vehicle 10.

Auxiliary Air Handler

The air treatment apparatus in accordance with the present invention may include an auxiliary air handler 21. Auxiliary air handler 21 is utilized to adjust the temperature of air delivered to an auxiliary compartment, such as a sleeping compartment, of the vehicle 10. Similar to air handler 22, auxiliary air handler preferably includes two heat exchanger modules for cooling or heating air delivered to the sleeping compartment. A first heat exchanger module (heater core module) may be coupled with fluid conduits 30, 32 and a second heat exchanger module (evaporator core module) may be coupled with fluid conduits 42, 44.

Air Treatment System Control

Referring to Fig. 3, the vehicle air treatment apparatus 20 of the present invention includes a processor 70 for monitoring and controlling temperatures within the passenger compartment 12 of the vehicle 10. The processor 70 is coupled with a plurality of actuators 60, 62, 89, 90, circulation fan 71 and temperature sensor 72 within the air handler 22 for controlling air flow through the air handler 22 into the passenger compartment 12. .

The processor 70 is additionally coupled with the refrigerant compressor 18 for selective engagement and disengagement of the clutch therein responsive to operator or automatic control. Further, processor 70 monitors temperatures of the evaporator core module 36. In particular, evaporator core module 36 is coupled with a temperature sensor

72 mounted adjacent the evaporator core module 36 for monitoring the temperature of the module 36. Processor 70 may automatically disengage the refrigerant compressor clutch in response to a condition wherein the evaporator core module 36 approaches freezing temperatures.

The processor 70 is preferably coupled with temperature sensors 73 within the passenger compartment 12 and sleeping compartment (if present) of the vehicle 10. Responsive to a change in temperature within the passenger or sleeping compartment of the vehicle 10, processor 70 may control the circulation fan 71 and air control valves 56, 58 via actuators 60, 62 within the air handler 22 to maintain preset temperatures defined by the operator controls 74. Alternatively, the vehicle operator may desire a change in air temperature by adjusting operator controls 74 within the passenger and sleeping compartments of the vehicle 10. The operator controls 74 are coupled with processor 70 as shown in Fig. 3. Therefore, processor 70 may either maintain a preset temperature or effect a change in temperature in response to operator adjustment of the manual operator control 74.

Air Handler

A preferred embodiment of the air handler 22 of the vehicle air treatment apparatus 20 in accordance with the present invention is shown in Fig. 4 - Fig. 8. Referring to Fig. 4, the air handler 22 includes an access plate 75 mounted on an upper surface thereof providing access to a circulation fan 71 which is preferably a centrifugal fan. Actuators 60, 62 for controlling air control valves 56, 58 within the air handler 22 are mounted within protective cases on the top surface of the air handler 22. Actuators 60, 62 rotate drive shafts provided through the top cover of the air handler 22 to rotate air control valves 56, 58 therein. Air control valves 56, 58 include a blend air door 56 and fresh air door 58 for controlling and directing treated air into the passenger compartment 12 of the vehicle 10. A defrost port 86 within the air distributor 83 is also shown toward the rear portion of the air handler 22. The defrost port 86 directs air toward the windshield of the vehicle 10 during a defrost mode of operation. The expansion valve 15 mounted to fluid port connectors 38, 40 of the evaporator core module 36, and fluid port connectors 26, 28 of the heater core module 24 are also shown in Fig. 4.

The right side of the air handler 22 is shown in Fig. 5. A primary drain conduit 67 and secondary drain conduit 68 are coupled with the bottom with the air handler 22. The primary drain conduit 67 is coupled with a port beneath the evaporator core module 36. Water condensation formed on the exterior of the evaporator core module 36 drips onto the lower case of the air handler 22 and may be removed via primary drain conduit 67.

Secondary drain conduit 68 is coupled with a port located beneath a chamber housing the circulation fan 71. Secondary drain 68 removes water condensation within the fan chamber 93 and is connected with the primary drain 67. Fluid port connectors 38, 40 are shown in Figure 5

Fig. 6 is a left side view of the air handler 22. The fresh air door 56 is shown in a first or recirculation air position. In particular, the fresh air door 58 is shown sealing a fresh air port 57. In this mode of operation, air is drawn from the passenger compartment 12 through a recirculation entry port 81 positioned in the rear of the air handler 22. Responsive to control signals from processor 70, actuator 62 may rotate fresh air door 58 into a second or fresh air position shown in Figure 8. In this second mode of operation air enters the air handler 22 through the fresh air port 57.

Fig. 7 illustrates the rear portion of the air handler 22 in accordance with the present invention. Recirculation port 81 includes a plurality of flappers 82 positioned thereacross preventing recirculated air from entering the air handler 22 during the fresh air mode of operation. During the recirculation mode of operation, flappers 82, which are constructed of a thin gasket material, open in response to a suction created by the circulation fan 71 thereby permitting recirculation air from the passenger compartment to enter into the air handler 22. A portion of the air distributor 83 of the air handler 22 is shown in Fig. 7. Air distributor 83 includes distribution ports 84, 85 for directing treated air into the passenger compartment 12 of the vehicle 10. Distribution port 84 directs air to the panel or dashboard level and port 85 directs air toward the floor of the passenger compartment 12.

Air Cooling and Heating

Referring to Fig. 8, air handler 22 may selectively supply either heated air or cooled air to passenger compartment 12 and may operate in either a fresh air mode or recirculation mode. In particular, the air handler 22 includes a first air control valve, referred to as blend air door 56, for controllably delivering one of heated air and cooled air to the passenger compartment 12 responsive to operator or automated control. The air handler 22 may additionally include a second air control valve, referred to as fresh air door 58, for controllably delivering either fresh air or recirculated air to the passenger compartment 12 responsive to operator or automated control.

As shown in Fig. 6, fresh air door 58 seals fresh air port 57 during the recirculation mode of operation. Circulation fan 71 draws recirculated air into the air handler 22 through recirculation port 81 and flappers 82. Alternatively, fresh air door 58 is opened during the fresh mode of operation as shown in Fig. 8. Opening fresh air door 58 permits air to flow directly into air handler 22 through the fresh air port 57. Flappers 82 seal recirculation entry

port 81 during the fresh air operating mode. Either the vehicle operator or processor 70 may control the mode of operation of the fresh air door 56 via actuator 62.

Fig. 8 shows that air drawn into the air handler 22 through either the fresh air port 57 or recirculation entry port 81 initially passes into a first chamber 92. Thereafter, the air is drawn through air filter 35 and evaporator core module 36. Air filter 35 removes airborne particles and may be easily replaced through orifice 50 within the front of air handler 22 during the removal of the evaporator core module 36. The air is cooled by evaporator core module 36 if the compressor clutch is engaged responsive to a control signal from processor 70.

The air is subsequently drawn into circulation fan chamber 93 through orifices (not shown) located at the top and bottom of the fan wall 94. Circulation fan 71 directs the air toward second control valve referred to as blend air door 58. Blend air door 56 may be positioned as shown in Fig. 8 to block the flow of air through the heater core module 24 during a cooling mode of operation. In particular, the air is cooled by the evaporator core module 36 and bypasses the heater core module 24. The cooled air is thereafter applied to the air distributor 83 and the passenger compartment 12 via a selected air distribution port 84, 85 or defrost port 86.

Alternatively, blend air door 56 may be positioned in a second position, represented by dashed lines shown in Fig. 8, during a heating mode of operation. In the second position, blend air door 56 directs the air through the heater core module 24 thereby increasing the temperature of the air. The heated air is subsequently directed to the air distributor 83 and passenger compartment 12. The position of blend air door 56 may be varied between the first position and second position to provide vary the degree of heating of the air.

Air Distribution

Referring to Fig. 7, panel and floor distributor ports 84, 85 of air distributor 83 are shown adjacent the recirculation port 81. The upper air distribution port 84 directs treated air into the passenger compartment 12 through the front panel therein. The lower air distribution 86 directs treated air toward the floor of the passenger compartment 12. As depicted in Fig. 4 and Fig. 9, defrost port 86 directs treated air toward the windshield of the vehicle 10.

Treated air is directed to the appropriate distribution port 84, 85 and defrost port 86 by distribution valves 87, 88 shown in Figure 9. Distribution valves 87, 88 are rotated by respective actuators 89, 90 responsive to control signals from processor 70. The operator may manually control or the processor 70 may automatically orient the positioning of distribution valves 87, 88 for directing the flow of air through distributor 83.

The treated air first enters the lower portion of the air distributor 83. The first distribution valve 87 may be positioned in a first or upward position, perpendicular to the outward face of the air distributor 83 to direct air toward the floor of the passenger compartment 12 through distribution port 84. In a second position, the distribution valve 87 is flush with the outward surface of the air distributor 83 directing treated air upward toward distribution port 85 and defrost port 86. The distribution valve 87 is shown in Figure 9 intermediate said first position and second position providing air to lower distribution port 84 and to defrost port 86.

The second distribution valve 88 directs the treated air through distribution port 85 to the panel in the passenger compartment 12 when it is positioned in a first upward position, perpendicular to the outward surface of the air distribution system 83. Alternatively, distribution valve 88 directs air toward the defrost port 86 when oriented in a second position flush with the outward surface of the air distribution system 83. The distribution valve 83 is shown in the second position in Figure 9. The positioning of distribution valves 87, 88 may be varied between the respective first and second positions thereof to simultaneously direct the treated air through more than one port 84, 85, 86.

Removal of Heat Exchanger Modules From The Air Handler

The first heat exchanger module or heater core module 24 and second heat exchanger module or evaporator core module 36 are removably engageable with the air handler 22. Heat exchanger modules 24, 36 may be quickly removed from the air handler 22 to facilitate servicing and maintenance of the components of the vehicle 10. The fluid conduits 30, 32, 42, 44 may remain coupled with respective port connectors 26, 28, 38, 40 and fluid connection ports 27, 29, 39, 41 during the removal of the heat exchanger modules 24, 36 from the air handler 22. Maintaining the connections of the fluid conduits 30, 32, 42, 44 eliminates the need to collect and/or recharge the heat transfer fluids, and reducing spillage of the fluids.

Air handler 22 includes chambers 52, 54 configured to receive a respective heater core module 24 or evaporator core module 36. The heat exchanger modules 24, 36 may be inserted through orifices 48, 50 in a front surface of the air handler 22 and slid into receptacle chambers 52, 54.

Chamber covers 25, 37 are positioned to maintain the respective heater core module 24 and evaporator core module 36 within corresponding chambers 52, 54 within the air handler 22. More specifically, heat exchanger cover 25 includes an upper portion and lower portion as shown in Fig. 10. Each portion of cover 25 may be slid vertically over orifice 48 to maintain the heater core module 24 within chamber 52. Further, cover portions 25 may

be slid apart for removal of the cover 25 to permit access to chamber 52 and heater core module 24 therein. Cover 37 may be slid horizontally to enclose chamber 54 maintaining evaporator core module 36 therein, or permit removal of the cover 37 allowing access to chamber 54 and evaporator core module 36.

Once servicing or maintenance is required, the covers 25, 37 may be removed and the heat exchanger modules 24, 36 slid outward from the chambers 52, 54 of the air handler 22. Preferably, fluid conduits 30, 32, 42, 44 and fluid port connectors 26, 28, 38, 40 remain connected to fluid connection ports 27, 29, 39, 41 of heater core module 24 and evaporator core module 36 during the removal of the modules 24, 36. Thereafter, the heat exchanger modules 24, 36 may be remotely located facilitating access to the air handler 22 itself and other vehicle components. The heat exchanger modules 24, 36 may be reinserted into the respective chambers 52, 54 of the air handler 22 with the fluid conduits 30, 32, 42, 44 attached thereto when servicing is completed. Covers 25, 37 may be replaced to maintain the heat exchanger modules 24, 36 within the air handler 22. Therefore, the heater core module 24 and evaporator core module 36 may be removed from and reinserted into air handler 22 without disconnecting fluid conduits 30, 32, 42, 44.

Fig. 11 shows the heater core module 24 and the evaporator core module 36 removed from the air handler 22. Heater module cover 25 and evaporator module cover 37 may be removed from the orifices 48, 50 of the front surface of the air handler 22 permitting access to the respective heat exchanger modules 24, 36 typically held within receptacle chambers 52, 54.

Methods

Additional aspects of this invention include novel methods of servicing and assembling a vehicle air treatment apparatus. The method of servicing the vehicle air treatment apparatus includes the steps of removing a heat exchanger module from the air handler. In addition, the method maintains the heat exchanger module in fluid communication with a fluid conduit connected thereto during the steps of disconnecting and removing. The heat exchanger is freed by releasing the modules from the air handler, such as by removing the cover 37. The heat exchanger modules can then be moved in a removing step so as to be removed clear of the air handler. This allows maintenance of the air handler without disconnecting the fluid conduit from the heat exchanger module and draining the refrigerant or coolant heat transfer fluid from the respective heat exchanger module. The methods may further include the step of removing the cover prior to removing the heat exchanger module.

The method for assembling the vehicle air treatment apparatus in accordance with the present invention includes the steps of coupling a fluid conduit to a heat exchanger module and connecting the heat exchanger module to the air handler such that air is passed adjacent to the heat exchanger module to affect the temperature of the air. The heat exchanger module is removable from the air handler with the fluid conduit coupled to the heat exchanger module. The methods can further include the step of supplying a heat transfer fluid to the heat exchanger module via the fluid conduit. In addition, the connecting step preferably includes sliding the heat exchanger module into a receptacle chamber within the air handler. The methods can further include securing the modules, such as by using a cover which may be installed adjacent to the chamber to maintain said heat exchanger module within said air handler.

The invention has been described in language more or less specific as to structural, methodological, or other aspects and features. It is to be more properly understood that the invention is not necessarily limited to the specific forms shown and described. Other equivalent structures and features may also be within the inventive concepts which are appropriately protected under the grant of patent rights being sought. The invention is therefore being claimed in an effort to define the invention but the various forms or modifications which the invention may take is difficult or impossible to define with certainty. Judgment must be utilized to properly interpret the scope of protection which is to be appropriately applied with regard to these new and inventive concepts.

Industrial Applicability

The invention is useful in the design, manufacture and servicing of vehicles, particularly trucks, buses and other larger sized vehicles.

CLAIMS

1. A vehicle air treatment apparatus for adjusting the temperature of air delivered to a passenger compartment of a vehicle, comprising:

an air handler connected to said vehicle for controllably delivering air to said passenger compartment;

at least one heat exchanger module removably coupled with said air handler such that the air is passed adjacent said at least one heat exchanger module to affect the temperature of the air;

said at least one heat exchanger module having a fluid connection port engageable with a fluid conduit for receiving a heat transfer fluid therefrom;

said at least one heat exchanger module being removable from said air handler with said fluid connection port coupled with the fluid conduit.

2. A vehicle air treatment apparatus according to claim 1 wherein said at least one heat exchanger module is slidably engageable with said air handler.

3. A vehicle air treatment apparatus according to claim 1 wherein said air handler includes at least one orifice on a front surface thereof for receiving said at least one heat exchanger module.

4. A vehicle air treatment apparatus according to claim 1 further comprising at least one cover for maintaining said at least one heat exchanger module within said air handler.

5. A vehicle air treatment apparatus according to claim 1 wherein said fluid connection port passes through a front surface of said at least one heat exchanger module.

6. A vehicle air treatment apparatus according to claim 1 wherein said air handler includes at least one air control valve for controlling delivery of fresh air or recirculated air to said passenger compartment.

7. A vehicle air treatment apparatus according to claim 1 wherein the heat transfer fluid is a coolant heat transfer fluid for increasing the temperature of the air.

8. A vehicle air treatment apparatus according to claim 1 wherein the heat transfer fluid is a refrigerant heat transfer fluid for reducing the temperature of the air.

9. A vehicle air treatment apparatus according to claim 1 wherein there are at least two heat exchanger modules, including a heater core module for selectably increasing the temperature of the air and an evaporator core module for selectably decreasing the temperature of the air.

10. A vehicle air treatment apparatus according to claim 9 wherein each of said heat exchanger modules is slidably engageable with said air handler.

11. A vehicle air treatment apparatus according to claim 9 wherein said air handler includes a first orifice and a second orifice on a front surface thereof for receiving respective ones of said heater core module and said evaporator core module.

12. A vehicle air treatment apparatus according to claim 9 wherein each said heater core module and said evaporator core module each include said fluid connection port through a respective front surface thereof.

13. A vehicle air treatment apparatus according to claim 9 further comprising a first cover and a second cover for maintaining respective ones of said heater core module and said evaporator core module within said air handler.

14. A vehicle air treatment apparatus according to claim 9 wherein said air handler includes:

a first air control valve for controllably delivering one of heated air and cooled air to said passenger compartment;

a second air control valve for controllably delivering one of fresh air and recirculated air to said passenger compartment.

15. A vehicle air treatment apparatus according to claim 9 wherein the heat transfer fluid within said heater core module is a coolant heat transfer fluid for increasing the temperature of the air and the heat transfer fluid within said evaporator core module is a refrigerant heat transfer fluid for reducing the temperature of the air.

16. A vehicle air treatment apparatus for adjusting the temperature of air delivered to a passenger compartment of a vehicle, comprising:

an air handler connected to said vehicle for controllably delivering air to the passenger compartment;

at least one heat exchanger module removably coupled with said air handler such that the air is passed adjacent said at least one heat exchanger module to affect the temperature of the air;

said at least one heat exchanger module having a fluid connection port engageable with a fluid conduit for receiving a heat transfer fluid therefrom;

whereby said at least one heat exchanger module can be removed from said air handler without disconnecting the fluid conduit from said fluid connection port.

17. A vehicle air treatment apparatus according to claim 16 wherein said at least one heat exchanger module is slidably engageable with said air handler.

18. A vehicle air treatment apparatus according to claim 16 wherein said air handler includes at least one orifice on a front surface thereof for receiving said at least one heat exchanger module.

19. A vehicle air treatment apparatus according to claim 16 further comprising at least one cover for maintaining said at least one heat exchanger module within said air handler.

20. A vehicle air treatment apparatus according to claim 16 wherein said fluid connection port passes through an outwardly facing surface of said at least one heat exchanger module.

21. A vehicle air treatment apparatus according to claim 16 wherein said air handler includes at least one air control valve for controlling delivery of fresh air or recirculated air to said passenger compartment.

22. A vehicle air treatment apparatus according to claim 16 wherein the heat transfer fluid is a coolant heat transfer fluid for increasing the temperature of the air.

23. A vehicle air treatment apparatus according to claim 16 wherein the heat transfer fluid is a refrigerant heat transfer fluid for reducing the temperature of the air.

24. A method for servicing a vehicle air treatment apparatus having an air handler and a heat exchanger module having a fluid connection port engageable with a fluid conduit for receiving a heat transfer fluid therefrom, the method comprising the steps of:

a. removing said heat exchanger module from said air handler;

b. maintaining said fluid connection port in fluid communication with the fluid conduit during said step of removing said heat exchanger module from said air handler;

whereby said heat exchanger module can be removed clear of said air handler to allow maintenance on said air handler without disconnecting the fluid conduit from said fluid connection port and draining the heat transfer fluid from said heat exchanger module.

25. A method for servicing a vehicle air treatment apparatus according to claim 24 wherein said heat exchanger module is at least one of a heater core module or an evaporator core module.

26. A method for servicing a vehicle air treatment apparatus according to claim 24 further comprising a step of removing a cover prior to removing said heat exchanger module from said air handler.

27. A method for servicing a vehicle air treatment apparatus according to claim 24 wherein the step of removing said heat exchanger module includes sliding said heat exchanger module out of a chamber within said air handler.

28. A method for assembling a vehicle air treatment apparatus having an air handler and a heat exchanger module having at least one fluid connection port, the method comprising the steps of:

a. connecting a fluid conduit to said at least one fluid connection port;

b. coupling said heat exchanger module to said air handler after step a) has been completed, such that air is passed adjacent said heat exchanger module to affect the temperature of the air; said heat exchanger module being removable from said air handler with the fluid conduit coupled to said at least one fluid connection port;

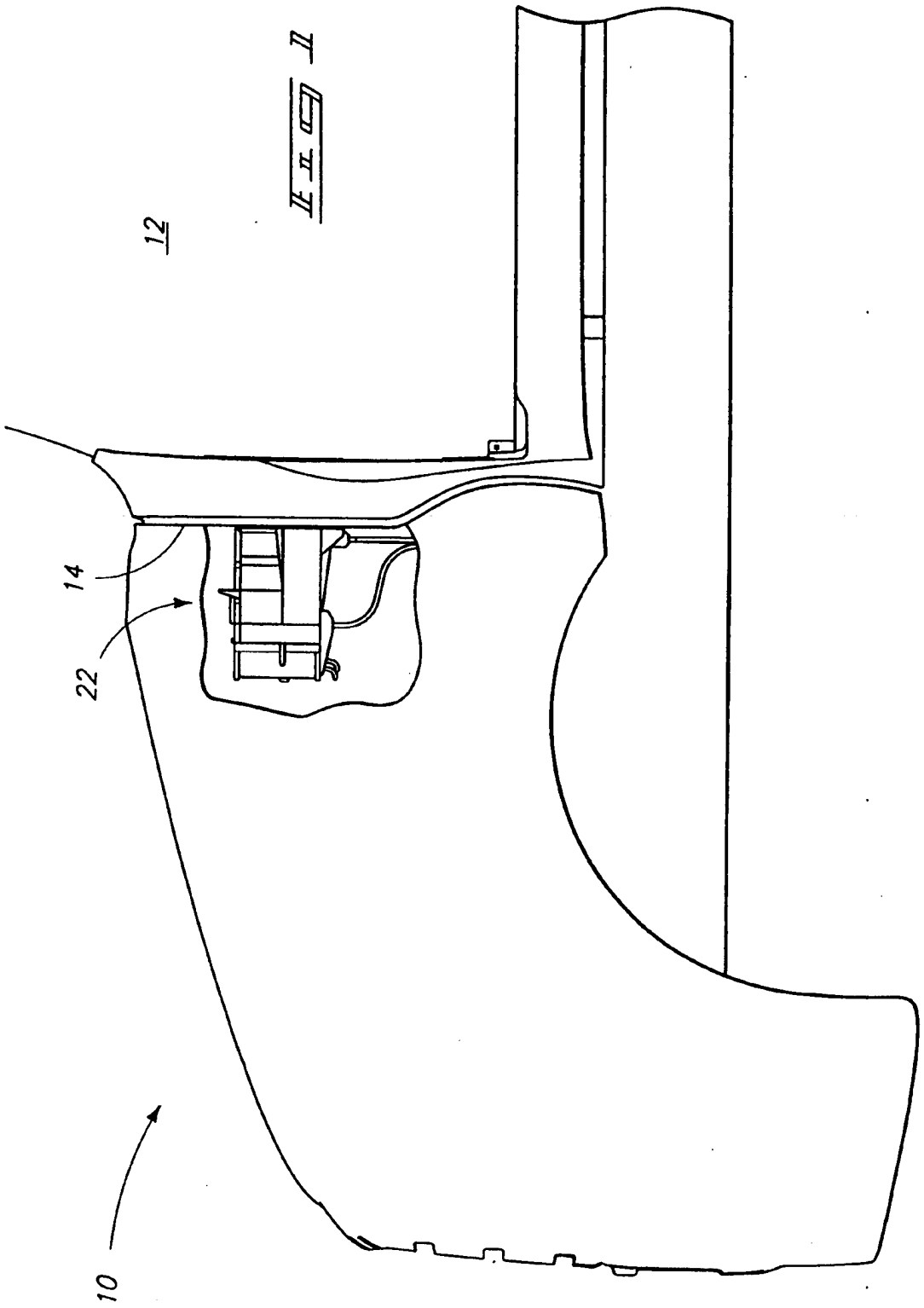
c. supplying a heat transfer fluid to said heat exchanger module via the fluid conduit and said at least one fluid connection port.

29. A method for assembling a vehicle air treatment apparatus according to claim 28 wherein said heat exchanger module is one of a heater core module and an evaporator core module.

30. A method for assembling a vehicle air treatment apparatus according to claim 28 wherein said coupling includes sliding said heat exchanger module into a chamber within said air handler.

31. A method for assembling a vehicle air treatment apparatus according to claim 28 further comprising the step of installing a cover to maintain said heat exchanger module in said air handler.

FIG 1



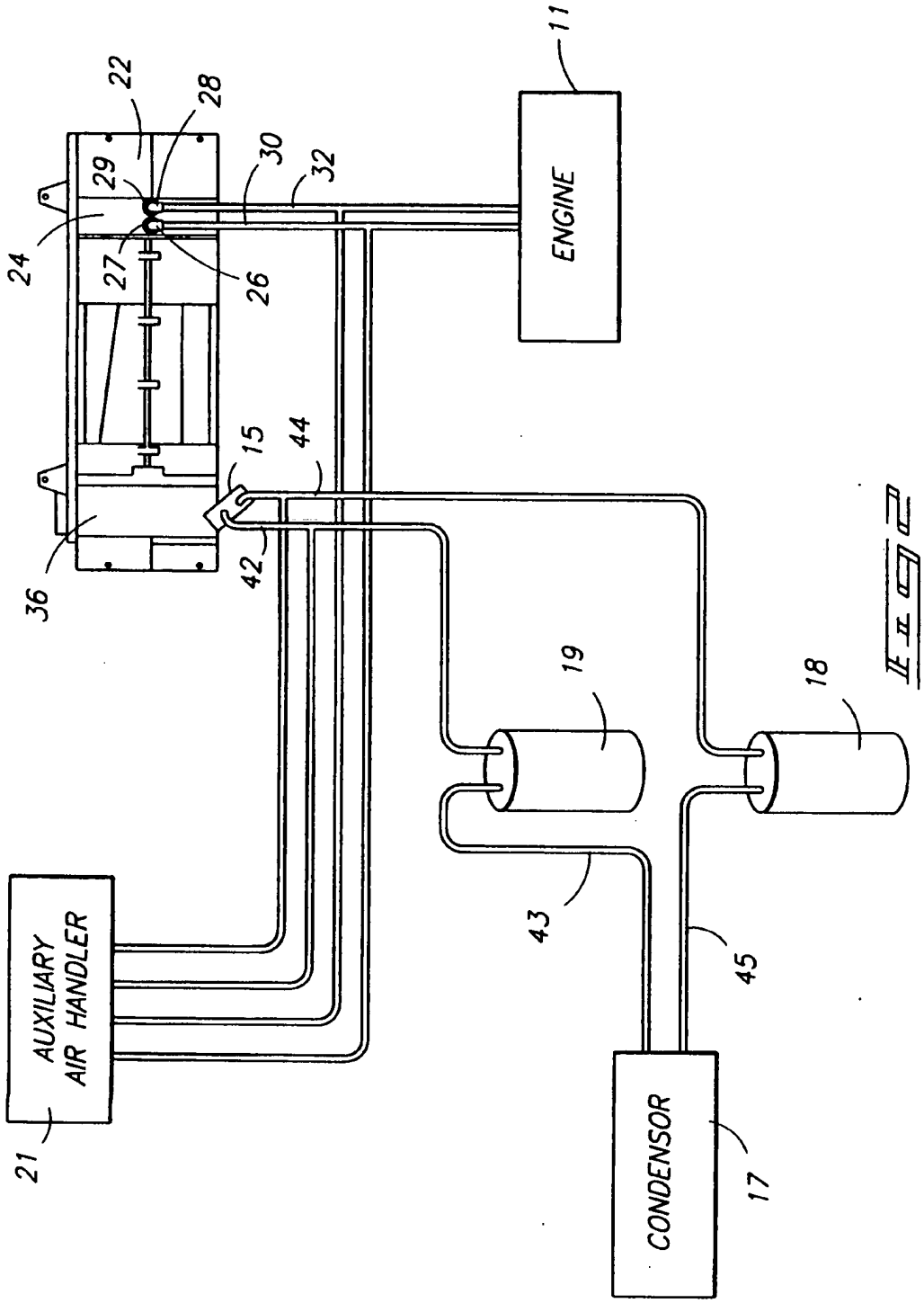

11
ENGINE
22
28
29
30
32
24
27
26
15
44
36
42
19
18
AUXILIARY
AIR HANDLER
21
43
45
CONDENSOR
17

FIG 2

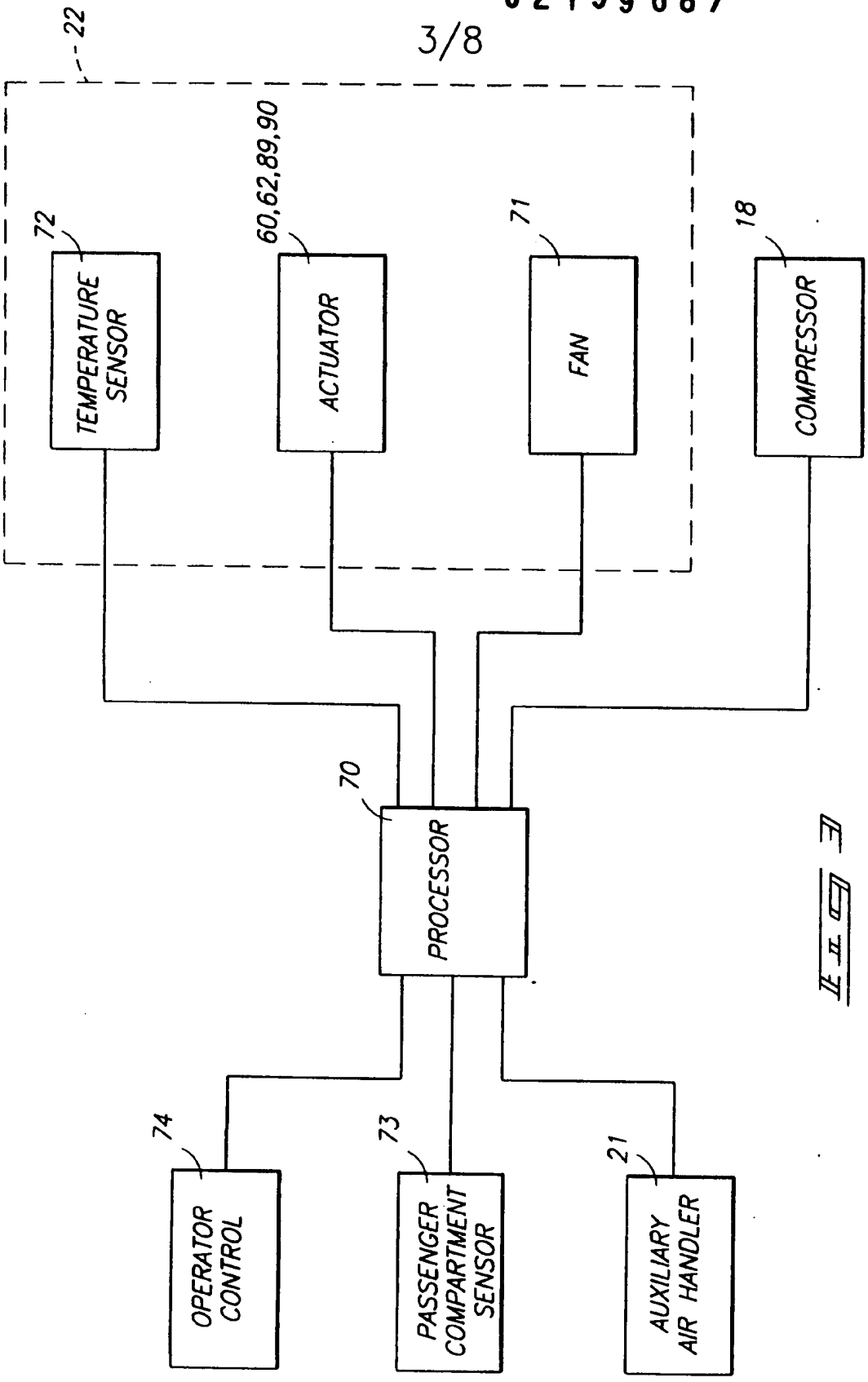

22
72
TEMPERATURE SENSOR
60,62,89,90
ACTUATOR
71
FAN
18
COMPRESSOR
70
PROCESSOR
74
OPERATOR CONTROL
73
PASSENGER COMPARTMENT SENSOR
21
AUXILIARY AIR HANDLER

FIG 3

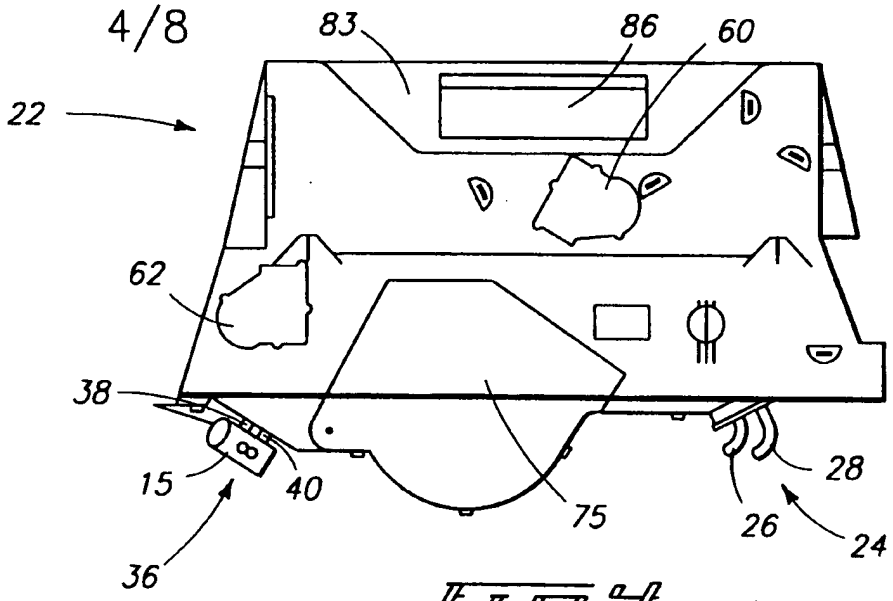

83
86
60
22
62
38
15
40
36
75
26
28
24

Fig 10

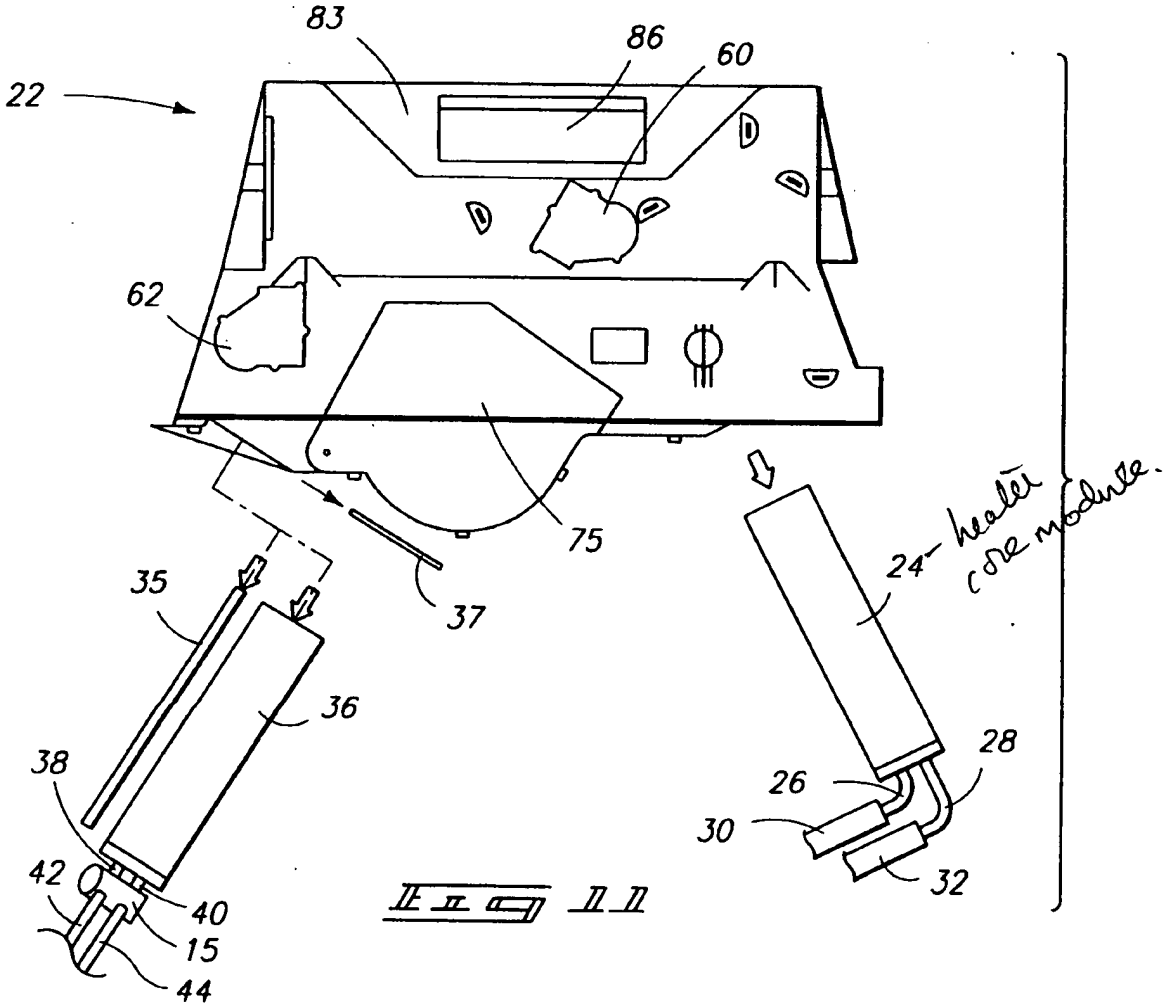

83
86
60
22
62
75
37
35
36
38
42
40
15
44
24- heater core module.
26
28
30
32

Fig 11

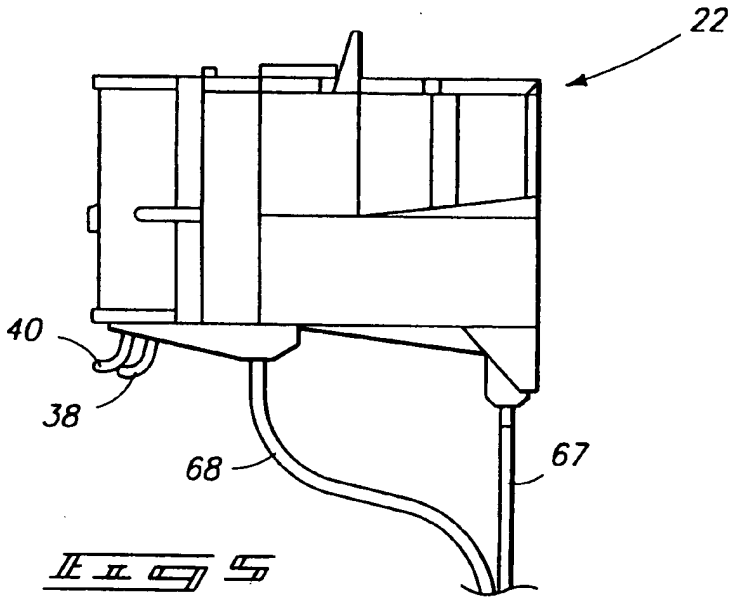


Fig 5

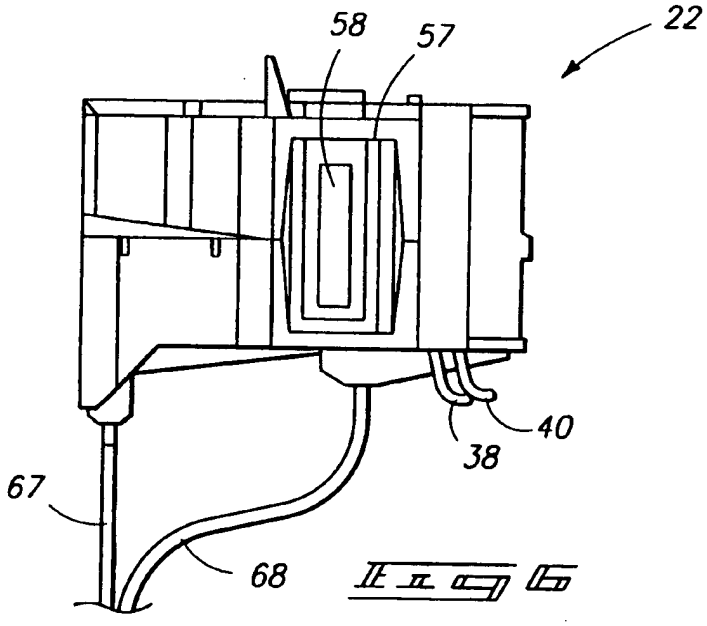


Fig 6

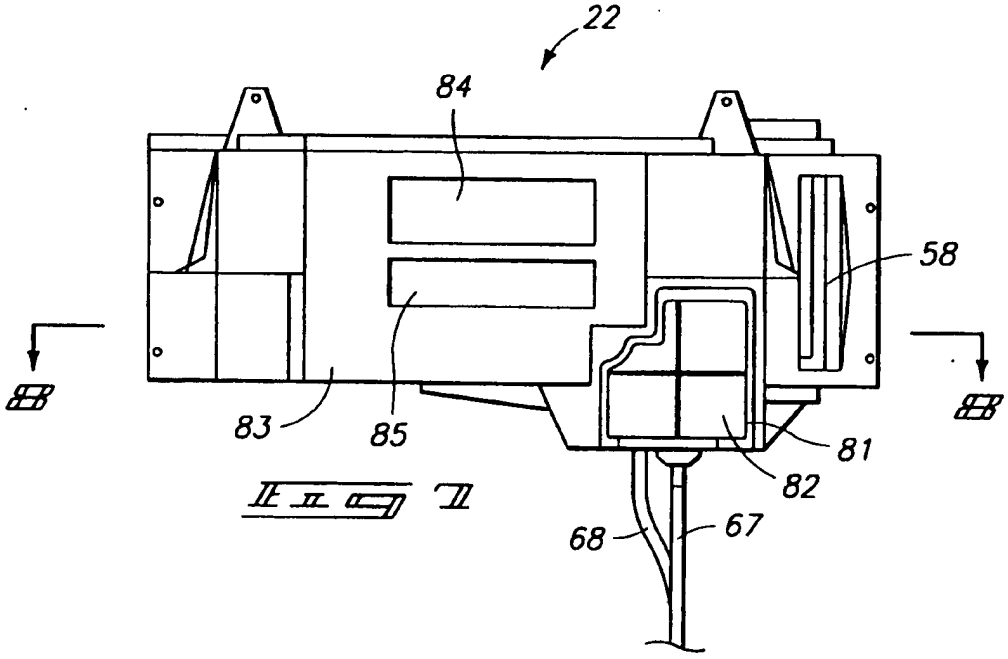


Fig II

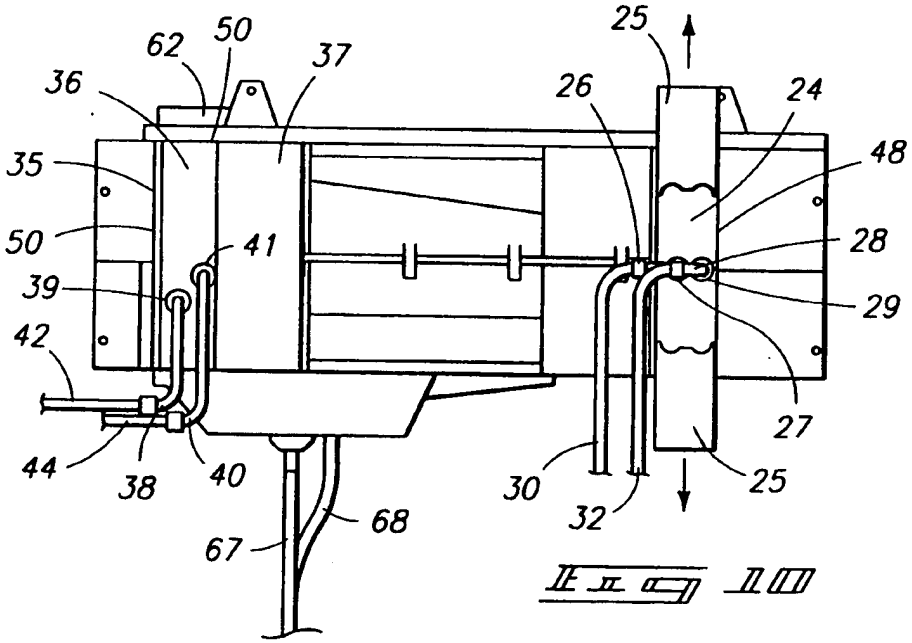


Fig III

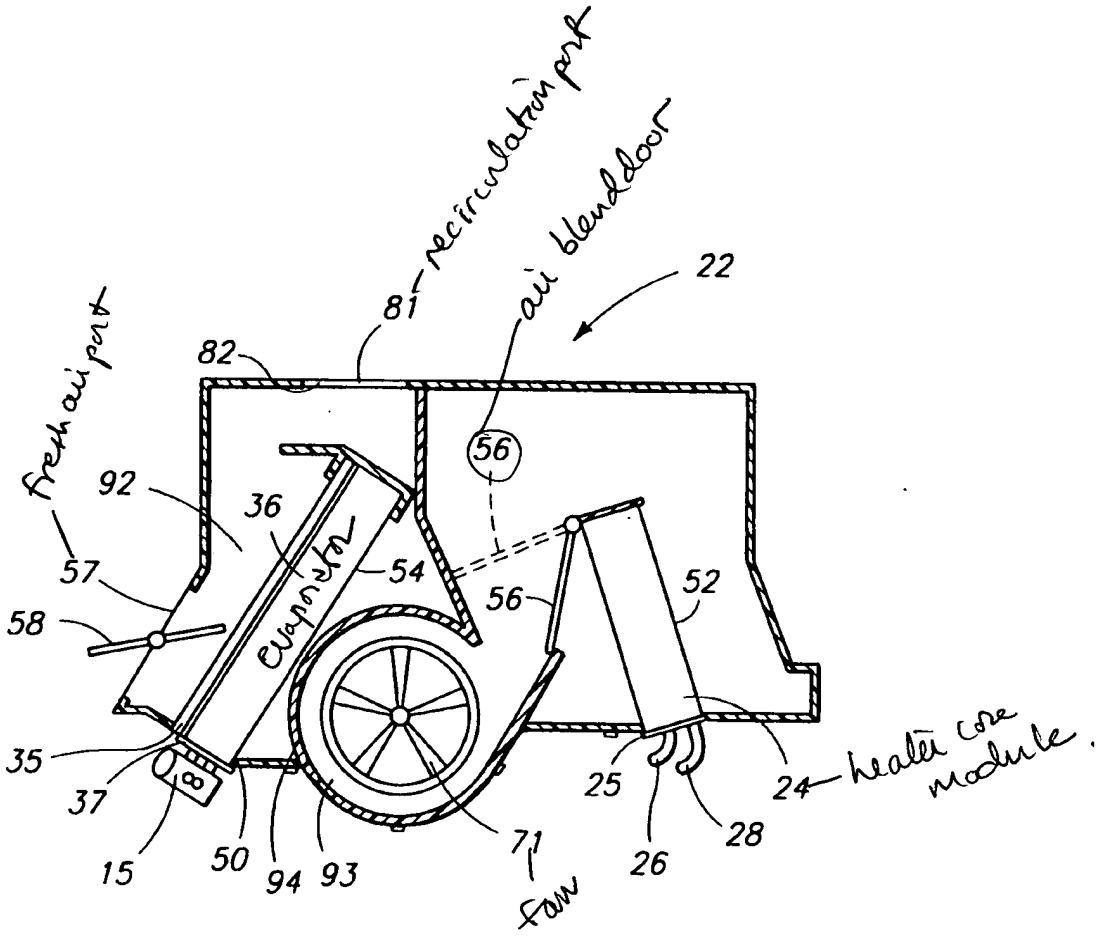

recirculation port
air blend door
22
81
82
fresh air port
92
36
57
58
evaporator
54
56
52
56
35
37
18
15
50
94
93
71
fan
25
26
28
24
heater core module.

Fig 8

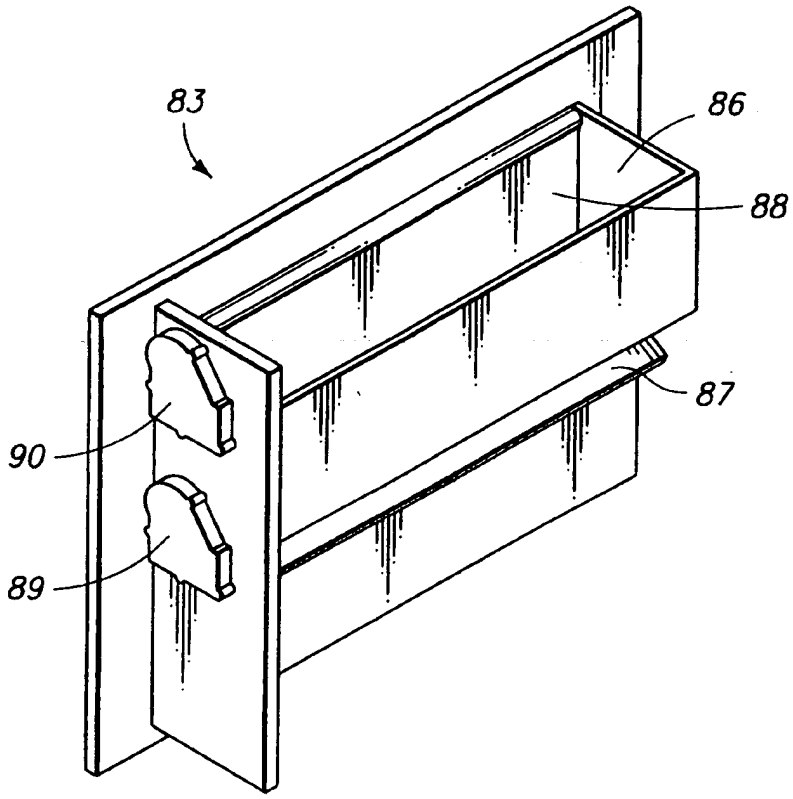


Fig 9